

Chapter 2: Alternatives

2.1 Alternative Development Process

This chapter summarizes the range of alternatives considered to address the purpose of and need for this project and identifies the alternatives advanced for further analysis in **Chapter 3**. In accordance with guidelines provided in FHWA's Technical Advisory T6640.8A, the No Build and a full range of Build Alternatives were considered. This section describes the alternative development process and summarizes each conceptual alternative considered. **Section 2.2** identifies the reasons each conceptual alternative was dismissed or advanced. **Section 2.3** provides a summary of the No Build and Build Alternatives advanced and evaluated in **Chapter 3**.

The following conceptual alternatives were developed as part of the Bridge Feasibility Study (UDOT, 2004e):

- No Build Alternative (two lanes remain from Potash Road to Moab)
 - Alternative 1 – No Build Alternative (on-going maintenance)
- Conceptual Build Alternatives (each includes four lanes from Potash Road to Moab)
 - Alternative 2 – Widen Existing Bridge
 - Alternative 3 – Construct a New Southbound Bridge
 - Alternative 4 – Construct a New Bridge with Pedestrian/Bicycle Facility on Existing Bridge
 - Alternative 5 – Construct a New Bridge (Staged)
 - Alternative 6 – Construct a New Bridge on an Alternate Alignment
 - Alternative 7 – Construct a New Bridge (Non-staged)

The typical sections for each conceptual alternative are illustrated in **Figure 2-1**. As shown in **Table 2.1-1**, only Alternatives 5 and 7 would achieve the project objectives and goals described in **Section 1.5**. Since Alternatives 5 and 7 satisfy these objectives and goals, the review of these alternatives also considered cost and potential impacts. Alternative 5 was found to provide the same benefits as Alternative 7 and result in less impact to surrounding properties and the environment. As such, this concept was advanced and further refined during the development of the Build Alternative.

Table 2.1-1 Ability of Conceptual Alternatives to Meet Project Objectives

Project Objectives	Alternative						
	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7
Provide a bridge that accommodates US-191 traffic and meets current structural design standards	No	No	No	No	Yes	Yes	Yes
Address safety concerns by upgrading shoulders	No	Yes	No	Yes	Yes	Yes	Yes
Provide adequate travel capacity and continuity	No	Yes	Yes	Yes	Yes	No	Yes
Facilitate the movement of bicycle and pedestrian traffic along US-191	No	Yes	Yes	Yes	Yes	No	Yes

2.2 Conceptual Alternatives Considered

2.2.1 Alternative 1 – No Build

Alternative 1 would consist of continuous maintenance and rehabilitation projects that UDOT considers necessary to maintain the bridge. With Alternative 1, both the bridge and roadway would remain as two lanes and shoulders would not be upgraded. The two-lane facility would operate at LOS E (an unacceptable LOS) by the 2030 design year. Although Alternative 1 does not satisfy the project objectives and goals, it is being advanced as the No Build Alternative in accordance with 40 CFR 1502.14 to serve as a baseline against which other alternatives are evaluated and compared. The No Build Alternative is described in further detail in **Section 2.3.1**.

2.2.2 Alternative 2 – Widen Existing Bridge

This alternative would provide a widened bridge that would consist of the existing bridge combined with an attached new bridge, allowing for four travel lanes, a median, and shoulders. Assuming it would be feasible to maintain the existing bridge, the four-lane facility would operate at LOS B (an acceptable LOS) by the 2030 design year. However, Alternative 2 leaves the existing bridge in place and does not eliminate the fracture-critical nature of the existing bridge or fix the problems associated with the bridge footings (as explained in **Section 1.4.1**). Consequently, Alternative 2 would not achieve current structural design standards and was not advanced for further study.

2.2.3 Alternative 3 – Construct New Southbound Bridge

This alternative would construct a new bridge to carry southbound traffic and use the existing bridge to carry northbound traffic. Assuming it would be feasible to maintain the existing bridge, the two structures would accommodate a total of four travel lanes and operate at LOS B (an acceptable LOS) by the 2030 design year. Although the new bridge would have standard shoulders, the width of the existing bridge for northbound traffic would not accommodate adequate shoulders. Also, Alternative 3 does not eliminate the fracture-critical nature of the existing bridge or fix the problems associated with the existing bridge footings. Consequently, Alternative 3 would not achieve current structural design standards and was not advanced for further study.

2.2.4 Alternative 4 – Construct New Bridge with Pedestrian/Bicycle Facility on Existing Bridge

This alternative would construct a new bridge adjacent to the existing bridge. The new bridge would carry four lanes of vehicular traffic as well as provide a median and shoulders. The existing bridge would remain in place to handle pedestrian and bicycle traffic. The four travel lanes on the new bridge would operate at LOS B (an acceptable LOS) by the 2030 design year. Because the existing bridge would remain for pedestrian and bicycle traffic, Alternative 4 does not eliminate the problems associated with the existing bridge footings. Also, if one of the girders on the existing bridge were to fail, even under pedestrian and bicycle traffic, the bridge could fail. Consequently, Alternative 4 would not achieve current structural design standards and was not advanced for further study. Also, the separate Colorado River Pedestrian Bridge Project provides a new crossing of the Colorado River for non-motorized pedestrian and bicycle traffic (see **Figure 1-3** and **Section 3.3.3**).

2.2.5 Alternative 5 – Construct New Bridge (Staged)

This alternative would construct a new bridge using staged construction that would include four lanes, a median, and shoulders. The alignment shift from the old bridge alignment to the new bridge alignment would be minimized by aligning the eastern edge of the new bridge with the eastern edge of the existing bridge. With staged construction, the bridge would be constructed in two stages. The existing bridge would carry traffic during the first stage of construction while half of the new bridge is constructed. During the second stage, the existing bridge would be demolished and the remaining half of the proposed bridge would be constructed. The resulting four travel lanes would operate at LOS B (an acceptable LOS) by the 2030 design year.

Since Alternative 5 is able to meet the project objectives and goals, the review of this alternative also considered cost and potential impacts. In general, the cost associated with staged construction is greater than non-staged construction. However, Alternative 5 would result in a narrower overall footprint than Alternative 7 (which is not staged). The increased cost is reasonable because Alternative 5 also would reduce impacts to private property, wetland areas, endangered species critical habitat associated with the Colorado River, and the Scott Matheson Wetland Preserve. Since Alternative 5 met each of the project objectives and goals while minimizing impacts to the surrounding environment, this concept was advanced and further refined during the development of the Build Alternative (see **Section 2.3.2**).

2.2.6 Alternative 6 – Construct New Bridge on Alternate Alignment

This alternative would construct a new bridge at a different crossing location with four lanes, a median, and shoulders, as well as new alignment that would eventually connect back to US-191. After construction of the new bridge and the realignment of US-191, the existing bridge would be removed. The suitability of other crossing locations was investigated within the confines of the mountain bluffs on each side of the Spanish Valley. This investigation concluded that a crossing could be located about 1.5 miles southwest of the existing bridge, along the western bluffs. This crossing location was based on the valley topography and the need to tie into existing roads while attempting to avoid wetland areas, the Scott Matheson Wetland Preserve, and the U.S. Department of Energy (USDOE) Moab Uranium Mill Tailings Remedial Action (UMTRA) site.

This southwest crossing would connect Kane Creek Boulevard to Potash Road and would require improvements to these roads. The improvements would consist of constructing about 1.5 miles of new roadway, widening the existing roadways and city streets, and new right of way with residential and farmland relocations. The improvements would extend over 4.5 miles (40% longer than following the existing US-191 alignment) and would involve constructing at least three major intersections or interchanges to connect with existing roads.

Alternative 6 was not carried forward for detailed study because it would not provide for continuity of the US-191 system. As stated in **Section 1.4.2.1**, 73 percent of US-191 traffic uses the bridge to access Moab. Since Alternative 6 involves realigning US-191 around Moab, the planned development in the North Corridor and many existing businesses and residences would not have immediate access to US-191 after the realignment. Though a realignment of US-191 does not meet the objectives identified for this project, Alternative 6 has received some public support and may be

considered in the future as a separate project for an additional bypass to divert trucks off of Main Street.

2.2.7 Alternative 7 – Construct New Bridge (Non-staged)

This alternative would construct a new bridge downstream of and adjacent to the existing bridge, eliminating the need for staged construction. The new bridge would include four lanes, a median, and shoulders. With Alternative 7, the existing bridge would carry traffic during construction and then be demolished after the new bridge is completed. Four travel lanes would result in LOS B (an acceptable LOS) and would accommodate the 2030 travel demand.

Since Alternative 7 is able to meet the project objectives and goals, the review of this alternative also considered cost and potential impacts. In general, non-staged construction is less expensive than staged construction. However, Alternative 7 would result in a wider overall footprint than Alternative 5 (which is staged). This wider footprint would include the width necessary for the new bridge as well as the previously disturbed area associated with the existing crossing. Alternative 7 was not advanced because it would result in additional impacts to private property, wetland areas, endangered species critical habitat associated with the Colorado River, and the Scott Matheson Wetland Preserve.

2.3 Alternatives Advanced

2.3.1 No Build Alternative

The typical sections associated with the No Build Alternative are shown in **Figure 2-2**. Although the No Build Alternative does not satisfy the project objectives and goals, it is being advanced in accordance with 40 CFR 1502.14 to serve as a baseline against which other alternatives are evaluated and compared.

Given that the US-191 Colorado River Bridge has a sufficiency rating of 47 and is classified as functionally obsolete (see **Section 1.4.1**), the No Build Alternative would consist of the continuous maintenance and rehabilitation projects that UDOT considers necessary to maintain the bridge and roadway. With the No Build Alternative, both the bridge and roadway would remain as two lanes. As explained in **Section 1.4.2**, a two-lane facility would operate at LOS E (an unacceptable LOS) by the 2030 design year. Also, vehicles traveling at the design speed in the four-lane sections (north and south of the project limits) would approach slower-moving or stopped vehicles in the two-lane section. This sudden limitation in traffic flow, as well as traffic queuing across the bridge, presents several safety concerns. There is

the potential for high-speed rear-end collisions near the merge points, the potential for an increase in sideswipe accidents as vehicles try to merge, and reduced response times for emergency vehicles crossing the river during periods of severe congestion.

The safety and geometric deficiencies of the bridge cannot be addressed through normal maintenance. The bridge is too narrow, cannot support modern loads, has parapets that no longer meet current crash safety criteria, the bridge foundation is scouring, and concrete is seriously degraded. With the No Build Alternative, the following maintenance and rehabilitation measures could be required in the future:

- Retrofit and rehabilitate bridge foundations,
- Seismically retrofit the bridge to conform to current bridge design specifications,
- Retrofit existing girders to add capacity for larger truck loads,
- Resurface the bridge deck and replace deck drains, deck joints, and girder bearings,
- Rehabilitate floor beams near expansion joints to mitigate corrosion,
- Rehabilitate columns and caps for piers, and
- Repaint steel girders for protection against moisture and corrosion.

Even if these measures were implemented, the safety, continuity, and capacity needs described in **Chapter 1** would not be met. And, although these measures would address some of the structural issues, the bridge would remain fracture-critical. If either girder gets damaged or develops fatigue cracks, the bridge could collapse.

2.3.2 Build Alternative – Proposed Preferred Alternative

2.3.2.1 Summary

The Build Alternative is illustrated in **Figures 2-3** through **2-6**. The preliminary bridge, roadway design, and alignment for the Build Alternative was developed using a series of review steps. These steps included both environmental and engineering considerations, as well as input from resource agencies, local entities, and public workshops. Similar to Alternative 5, the Build Alternative would construct a new bridge using staged construction that would provide four travel lanes, with a median and shoulders. The existing bridge would carry traffic during the first phase of construction while half of the new bridge is constructed. During the second phase of construction, the existing bridge would be demolished and the remaining half of the proposed bridge would be constructed. The design speed between 400 North and the

US-191 Colorado River Bridge would match the design speed of the Moab Main Street Project, which is 40 mph. North of the bridge, the design speed would be 60 mph to match the design speed of the Moab to I-70 Project north of the study area.

The Build Alternative is proposed as the Preferred Alternative because it would meet the project objectives and goals while minimizing impacts. Impacts to private property, wetland areas, parks, trails, cultural resources, endangered species critical habitat associated with the Colorado River, and the Scott Matheson Wetland Preserve have been minimized or avoided by the Build Alternative.

Figure 2-3 shows the various typical sections associated with the Build Alternative, and a plan view is provided in **Figure 2-4**. The Build Alternative satisfies the project objectives and goals because it would provide a bridge that accommodates US-191 traffic over the Colorado River and would also meet current structural design standards. Safety would be improved throughout the US-191 Colorado River study area by upgrading shoulders and meeting design standards. Safety, as well as driver comfort, would also be improved with the median that would physically separate opposing lanes of traffic and improve left-turn access. The four-lane section would meet the existing and projected travel demand through the design year 2030 and provide continuity between the four-lane sections north and south of the project limits. Bicycle and pedestrian movements along US-191 would be facilitated by the addition of shoulders, sidewalks, and/or separated paths.

The Build Alternative is further described in the following sections, along with likely construction methods that pertain to each section. Since funding for the entire project is not yet secured, likely phasing is also discussed.

2.3.2.2 US-191 Colorado River Bridge Replacement – Phase 1

Phase 1 would replace the bridge and necessary roadway approaches. Between the bridge and the Courthouse Wash Kiosk, a separated facility for non-motorized bicycle and pedestrian traffic is also included in Phase 1.

The US-191 Colorado River Bridge would include four 12-foot travel lanes, a six-foot open median, eight-foot shoulders, plus a two-foot offset to the barrier. The bridge type would be determined during final design, but is expected to consist of a new steel or concrete girder bridge with four to seven spans, as shown in **Figure 2-5**. A sidewalk is not included as part of the bridge section because the Colorado River Pedestrian Bridge Project provides a new crossing of the Colorado River for bicycle and pedestrian traffic (see **Figure 1-3**).

To accommodate traffic during construction and minimize impacts, the bridge would be constructed in two stages. The initial stage would be built west of the existing bridge and would include two through lanes of traffic, shoulders, and barriers. Once this work is completed, traffic would be moved to the completed section of the new structure and the second stage would remove the existing bridge to complete the widening. Two lanes of traffic would be maintained during peak traffic periods, but short-term closures may be needed to move equipment or set girders.

Several constraints in this segment that have influenced the design and alignment of the bridge and roadway include:

- South of the US-191 Colorado River Bridge, the alignment and elevation need to tie back into the existing roadway to minimize impacts associated with the SR-128 intersection. The trail crossing under the bridge on the south side of the Colorado River would be restored.
- Since the new bridge girders could be about three feet deeper than the existing girders, the bridge and roadway pavement surface elevation was raised approximately three feet to maintain the existing vertical clearance between the Colorado River and the structure. (The actual minimum vertical clearance requirements will be determined during final design of the structure).
- North of the bridge, the alignment and elevation needs to tie into the centerline of the existing Courthouse Wash Structure. The proposed bridge alignment includes a minor skew from the existing bridge alignment in order to achieve an acceptable roadway geometry that meets AASHTO design standards and to avoid encroaching into the rock slope associated with Arches National Park.

Construction of the new US-191 Colorado River Bridge would include excavating for the placement of the new abutments, driving piles, forming and placing concrete for new abutments, and removing existing abutments. Construction of the new piers could include drilling circular columns into bedrock. In the deep water, this would require the contractor to mobilize a drill rig mounted on a barge. The contractor would drive a steel casing to bedrock, drill into bedrock from inside the casing, place a reinforcing cage inside the casing, and then place concrete in the casing. The steel casing could be designed to be removed or to remain in place. Another option would be to drive sheet piling and create a cofferdam in the river areas. This would include placing a mud slab, driving piling or drilling circular shafts, and dewatering. The steel sheet piling would be removed after construction is completed. Either barge mounted cranes or cranes in the cofferdams would be used to install the spans. In

order to construct the new piers, abutments, or spans on the river bank, the contractor would need to construct a path approximately 15-feet wide for equipment access.

Removal of the existing bridge requires removal of the piers and their stepped circular foundations. All portions of the foundations above the bottom section (originally below mudline) should be removed so that the remaining foundation is three to six feet below the very low flow condition. If a new footing overlaps the existing footing, the entire existing footing must be removed. The method used to remove the existing bridge deck depends on feasibility. A structure removal plan prepared by the contractor would be approved by UDOT. Different options include building a platform below the existing deck in between the girders to catch falling debris, using a barge to catch the debris, or cutting the deck into slabs and using cranes to remove them.

2.3.2.3 *Roadway Widening Between 400 North and the US-191 Colorado River Bridge – Future Phase*

This segment would remain in its current condition until additional funding becomes available. This roadway section would include four 12-foot lanes, a 12-foot median, and eight-foot shoulders to tie into the roadway section for the Moab Main Street Project at 400 North.

The proposed alignment would typically follow the centerline of the existing road and tie into the improvements associated with the Moab Main Street Project near 400 North. Since the design in this section includes curb and gutter, the elevation of the road varies from the existing condition where the minimum slope requirements could not be achieved otherwise. To minimize property impacts associated with the wider road, the proposed elevation has also been modified from the existing condition between 500 West and 400 North and at some major driveways. Two commercial properties on the east side of US-191 may be displaced. One currently vacant commercial building on the west side would also be removed.

Moab City and Grand County are in the process of designing a 10-foot meandering bicycle and pedestrian path along the east side of US-191 (from approximately 600 North to SR-128) and expect construction in 2007. Though UDOT is coordinating both projects, portions of the proposed path would likely need to be rebuilt as part of the Build Alternative to accommodate the widened road. This situation is expected to occur in areas where substantial cuts and/or retaining walls would be required. The exact locations of the reconstructed trail segments would be identified during final design of the roadway and are expected to be within the proposed right of way through the use of retaining walls, as necessary. Plans for a potential landscaped

median would also be finalized during design in coordination with Moab City and Grand County. A six-foot sidewalk is proposed in developed areas where the meandering path is not provided. In undeveloped urbanized areas, the proposed right of way width would accommodate a future sidewalk where the meandering path is not provided.

Primary construction activities associated with roadway widening and modifications include clearing and grubbing; removal of asphalt and roadway excavation; placement of granular borrow, untreated base course, asphalt roadway surface, and concrete curb, gutter, and sidewalk; as well as signing, striping, and erosion control. Proposed utility and storm drain relocations and adjustments would be placed prior to new subgrade placement. Material would be obtained from or disposed of in approved location(s).

2.3.2.4 Courthouse Wash Structure Widening – Future Phase

The existing Courthouse Wash Structure would remain in its current condition until additional funding becomes available. Once funding is secured, the proposal would widen the existing structure. The widened structure (as shown in **Figure 2-6**) would provide four 12-foot lanes, a six-foot open median, and five-foot shoulders to match the roadway section associated with the Moab to I-70 Project near Potash Road, as well as a 10-foot attached path for non-motorized bicycle and pedestrian traffic. Most widening would occur to the south; however, some widening to the north would be needed to accommodate the two-way attached path.

Widening the Courthouse Wash Structure would involve widening the abutments and setting new girders on each side of the structure. The deck would then be formed and poured. If necessary, protective riprap may be added and/or the existing riprap replaced. Riprap may extend down to the edge of the channel and would be anchored in. Some construction activities – such as placing the deck, abutments or roadway/trail improvements – may take place from the banks when the wash is flowing. Riprap placement and anchoring would occur when the wash is dry.

2.3.2.5 Roadway Widening Between the US-191 Colorado River Bridge and Potash Road – Future Phase

Most of this segment would remain in its current condition until additional funding becomes available. This section would provide four 12-foot lanes, a six-foot open median, and five-foot shoulders to match the roadway section for the Moab to I-70 Project near Potash Road. The location and elevation of the roadway would tie into the constraints associated with the Courthouse Wash Structure and the recently

completed section of roadway just south of Potash Road. The shoulders would transition from eight to five feet between the Colorado River and Courthouse Wash. In this section, Phase 1 would include roadway approaches necessary to accommodate the new US-191 Colorado River Bridge and a separated path for non-motorized pedestrian and bicycle traffic between the bridge and the Courthouse Wash Kiosk. However, the existing attached path on the Courthouse Wash Structure would not be widened in Phase 1.

Primary construction activities associated with roadway widening and modifications would be similar to those described in **Section 2.3.2.3**.

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